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(54) Vehicle safety arrangement

(57) In order to improve the safety of a passenger or driver of a motor vehicle, means are provided to sense the position of the passenger or driver relative to the seat 4, 5, and to generate a signal whenever the person is not in the correct position on the seat. This signal may be used to activate an alarm or may be used to modify the operation of an air-bag or the like. The position may be determined by the length of safety belt withdrawn from a retractor reel, or using an optical or acoustic signal.

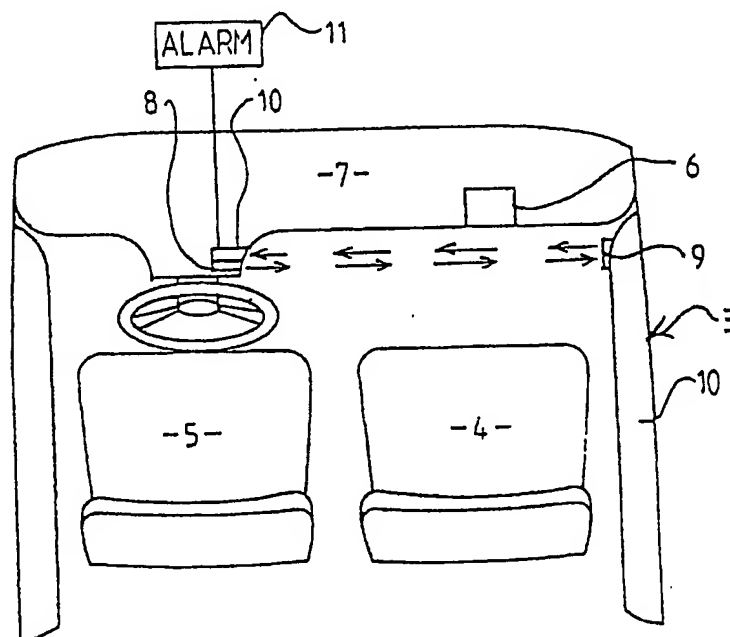


FIG 2

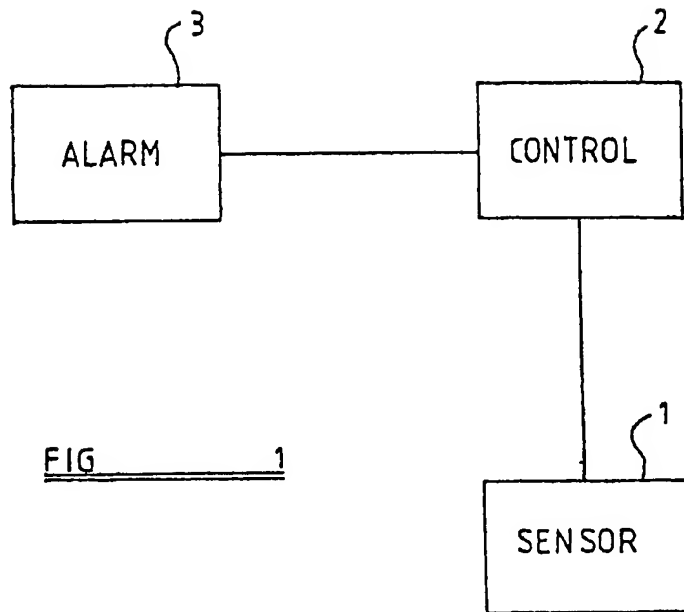


FIG 1

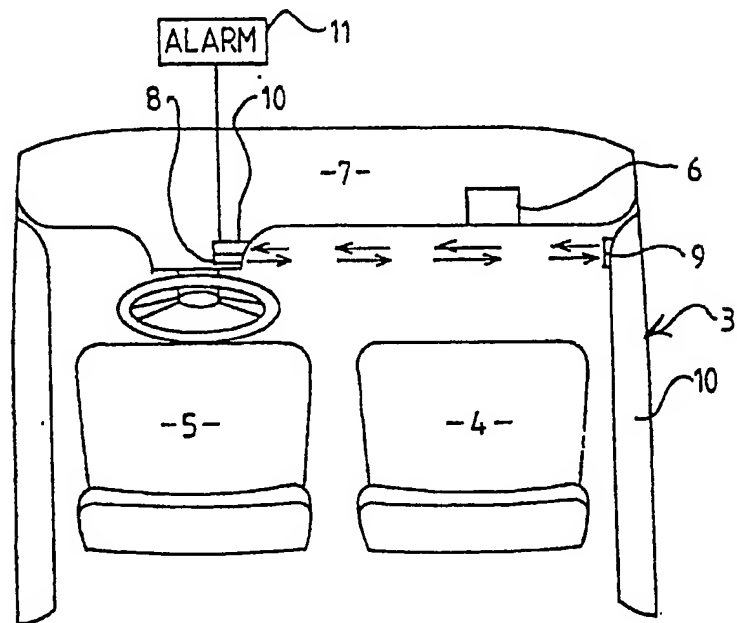


FIG 2

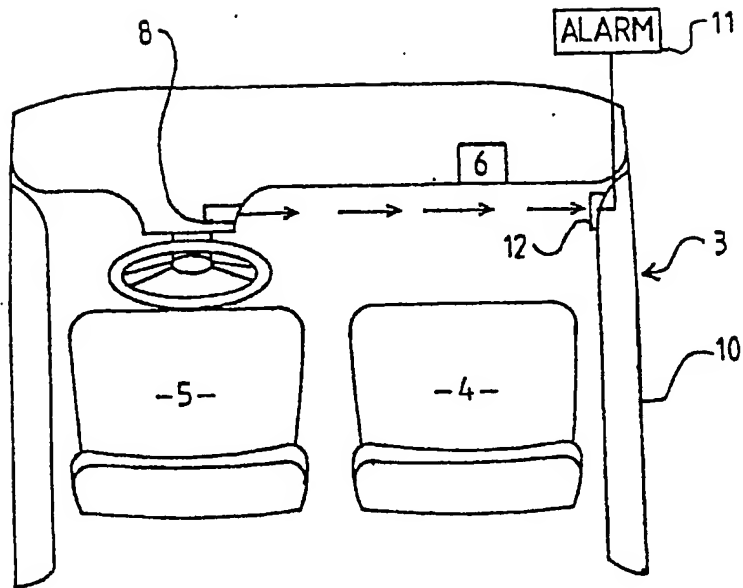


FIG 3

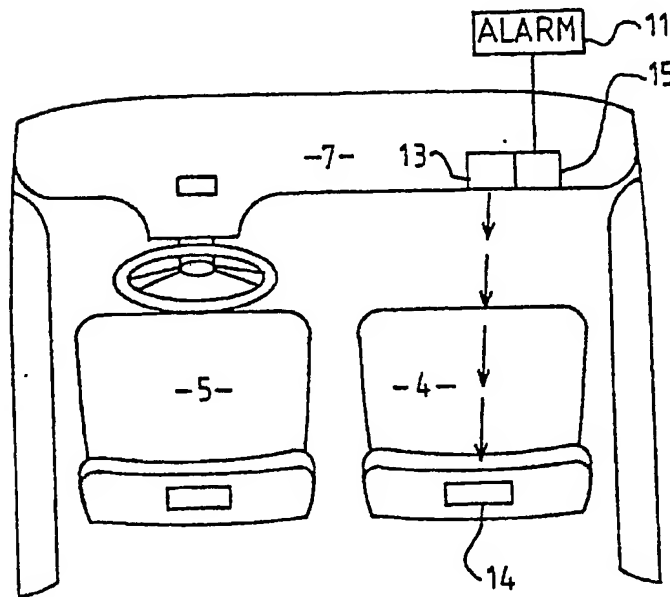


FIG 4

## Description of Invention

### "Improvements in or relating to a safety arrangement"

THE PRESENT INVENTION relates to a safety arrangement and more particularly to a safety arrangement adapted for use to protect a driver or passenger in a motor vehicle.

5           It has been proposed previously to provide various arrangements to restrain a person within a motor vehicle in the event that an accident arises and the vehicle decelerates suddenly. It is to be understood that in an accident situation when a motor vehicle is involved in a  
10           collison, or otherwise decelerates very suddenly, whilst the vehicle itself may decelerate, any person within the vehicle will tend to continue travelling forward, due to inertia, at the same speed as before the impact. It is thus necessary to decelerate the person before that  
15           person impinges on part of the motor vehicle, such as the steering wheel or dashboard.

          It has been proposed previously to provide safety belts or harnesses to perform this function and also it  
20           has been proposed to provide so-called "air bags" which are bags which are normally in a de-flated condition, but which are provided with means adapted to inflate the bag rapidly in an accident situation so that the bag is then positioned to cushion the movement of a person within a  
25           motor vehicle.

          It has been found that a conventional safety belt will operate in a satisfactory manner if the person wearing the safety belt is sitting properly in the seat  
30

at the time that an accident occurs. If, however, a person is leaning forwards at the time that the accident occurs, then the person can be very close to the dashboard or steering wheel and the safety belt may not be able to provide the required deceleration of the person before that person has impinged the dashboard or steering wheel, suffering severe injuries. Thus it is desired to be able to minimise the risk of a person leaning forward for an undue period of time. Also, some people when wearing a safety belt, tend to pull a slight extra length of the belt out of the retractor reel, so that the belt is not tight across the chest of the person wearing a safety belt. If such a person is involved in an accident, that person will travel forwardly, relative to the vehicle, by a distance related to the length of slack pulled out of the retractor reel before the safety belt will even begin to provide a decelerating effect.

When air bags are utilised the situation is rather more complicated. When a person in a motor vehicle is not in the normal position sitting fully in the seat, the distance to the dashboard or steering wheel may be reduced (to say that the distance during which deceleration must be effected is reduced) and the person may be very close to or at an angle relative to the air bag when it is inflated, which could lead to an additional injury caused by the air bag itself. Normally the air bag is retained, in the deflated condition, within the hub of the steering wheel or in a special recess provided in the dashboard. The bag is designed to inflate very rapidly substantially to fill the space between the hub of the steering wheel (or the compartment in the dashboard) and the person to be restrained by the air bag very rapidly indeed. The air bag is designed to be fully inflated when the person to be restrained thereby impinges on the air bag. If the person to be restrained by the air bag is, however, very close to the

5        hub of the steering wheel or very close to the  
compartment in the dashboard when the air bag begins to  
inflate, then the air bag itself can hit the person to be  
restrained thereby with sufficient force to injure that  
person.

      The present invention seeks to provide an improved  
safety system.

10        According to this invention there is provided a  
safety arrangement for use in a motor vehicle, said  
arrangement comprising means to sense the position of a  
person in a motor vehicle relative to the seat and to  
15        generate a signal indicative of the fact that the person  
is not in the correct position on the seat and means to  
activate an alarm in response to said signals, the alarm  
may comprise a visible alarm or comprises an audible  
alarm.

20        The arrangement may incorporate an air bag, and  
the alarm may comprise means to modify the operation of  
the air bag.

25        Preferably the means to sense the position of a  
person in a motor vehicle comprise means adapted to  
determine when the length of the safety belt, which is to  
restrain the person, withdrawn from a retractor reel  
associated with the safety belt exceeds a predetermined  
limit.

30        Conveniently the alarm is only activated when the  
length of belt withdrawn from the reel has exceeded the  
predetermined limit for a predetermined period of time.

35        7.        Conveniently the means to activate the alarm are  
adapted to determine the length of belt withdrawn from a  
retractor reel to retain a person within a seat in a

motor vehicle and to sense when a predetermined additional length of belt is withdrawn from the reel.

5 Preferably, an optical sensor is provided to sense the withdrawal of belt from the reel.

10 Advantageously said sensing means comprising means adapted to transmit a signal and to detect a signal, the nature of the detected signal being modified if the person is not in the correct position in the seat.

15 Preferably the signal is transmitted laterally of the motor vehicle, and the signal path is blocked by a person when not in the correct position in the seat.

The signal may be an optical signal or an acoustic signal.

20 Preferably the signal is transmitted laterally of the motor vehicle and is reflected back to a detector adjacent the transmitter.

25 Alternatively the signal is transmitted laterally to a motor vehicle from a transmitter to a detector.

~~25~~ Alternatively the signal is transmitted axially of the motor vehicle.

30 Preferably the signal is an acoustic signal and the time taken for the signal to be transmitted from a transmitter and to be reflected by the person sitting on the seat and to be detected at a detector is measured, in the manner of an echo sounder.

35 Alternatively the signal is an electromagnetic signal and the time taken for the signal to be transmitted, reflected by a person sitting in the seat

and detected by a detector is measured, in the manner of a radar system.

5 Alternatively the sensing means comprises an optical range-finding apparatus.

In one embodiment an air bag is provided, and wherein the alarm comprises means to modify the operation of the air bag.

10

Preferably the operation of the air bag is modified in that not all of the gas generating capability of the air bag is utilised.

15 Alternatively the operation of the air bag is modified in that an exhaust port for the air bag is opened when the air bag is inflated.

20 Alternatively the operation of the air bag is modified in that the air bag consists of two concentric air bags, only the inner air bag being inflated when the alarm is activated.

25 In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

30 Figure 1 is a block diagram of one embodiment of the invention;

35 Figure 2 is a diagrammatic view illustrating the front portion of a motor vehicle as viewed from above illustrating the essential components of one embodiment of the invention;

Figure 3 is a view corresponding to Figure 2 illustrating a modified embodiment of the invention; and

5 Figure 4 is another view corresponding to Figures 2 and 3 illustrating another embodiment of the invention.

Referring to Figure 1, a simple embodiment of the invention comprises a sensor 1 which is adapted to sense the amount of safety belt that has been withdrawn from a retractor reel. The sensor may be incorporated within the  
10 retractor reel and may take any appropriate form. Thus the sensor may be an optical sensor adapted to respond to optical markings provided on the belt or may be a sensor adapted to sense the rotations of the shaft upon which  
15 the belt is wound, either in response to optical markings provided on the shaft or other markings that can be sensed by the sensor. The sensor may alternatively respond to magnetic elements incorporated within the belt, or mounted on the shaft, or may determine the  
20 amount of safety belt left on the reel, by sensing the diameter of the coil of safety belt on the reel. It is to be appreciated that many different types of sensor may be utilised, in addition to those specified above.

25 The output of the sensor is transferred to a control arrangement 2 which may comprise an appropriately programmed microprocessor or the like. The function of the control arrangement 2 is to determine when a length of safety belt in excess of a predetermined length has  
30 been withdrawn from the retractor reel associated with the sensor 1 and has remained withdrawn for a period of time in excess of a predetermined period of time. Thus the control will not respond if a person wearing a safety belt merely leans forward briefly to withdraw some item  
35 from the glove box in the motor vehicle or, for example, to look round a corner before driving the motor vehicle round the corner, but will, however, respond when a

person leans forwardly can stays in a forward position.  
The control 2 may be associated with the speedometer in  
the motor vehicle so that the control is dis-abled when  
the motor vehicle is stationary. The output of the  
5 control is supplied to an alarm 3. In a simple  
embodiment of the invention the alarm may comprise an  
audible or visible alarm which provides an indication  
that the person wearing the safety belt is sitting in an  
incorrect and dangerous position. The alarm will remain  
10 activated until the person returns to the proper position  
sitting fully in the seat.

It is to be appreciated that people of different  
sizes may wear safety belts and thus the sensor and the  
15 control may be rather sophisticated, with the sensor  
providing output signals indicative of the length of belt  
that has been withdrawn and the control being program to  
sense the amount of safety belt withdrawn by a person  
when putting the safety belt on, and then to sense the  
20 amount of belt that is immediately retracted into the  
reel as the person sits in the seat. Thus a "norm" the  
amount of belt to be withdrawn from the retractor may be  
determined and stored within a memory within the control.  
The control may activate the alarm when the length of  
25 safety belt withdrawn from the retractor exceeds that  
"norm" by a predetermined amount. This will provide an  
added degree of safety since the amount of safety belt  
withdrawn before the alarm is activated is not a  
predetermined amount of safety belt, but is determined  
30 having regard to the normal amount of safety belt  
required to retain the person firmly within their seat.

Whilst, in the described embodiment of the  
invention, the alarm comprises an audible or visible  
35 alarm, the alarm may comprise a mechanical alarm which  
applies a tension to the safety belt tending to re-wind  
the safety belt. Also, in a motor vehicle where the

safety belt is associated with the sensor 1 is provided as an addition to an air bag the alarm 3 may be adapted to modify the operation of the air bag. Thus, if the alarm is activated, indicating that the person is in a forward position, if the air bag has to be activated, the air bag may be activated utilising, for example, only half of the gas generating capacity normally used or the air bag may be inflated with an exhaust port to the air bag opened, so the air bag is not inflated as rapidly as would ordinarily be the case, and is not inflated as fully as would ordinarily be the case. Thus the risk of the air bag injuring the person who is in a forward position will be minimised.

It is to be appreciated that if the embodiment of Figure 1 is utilised the sensor will respond to a length of belt being withdrawn, by hand, from the retractor reel so that the belt is only held loosely across the chest of the person wearing the belt and such action will serve to trigger the alarm.

It is to be noted that it is envisaged that a motor vehicle fitted with air bags may not be fitted with safety belts. Thus, whilst the embodiment is referred to Figure 1, and as described above may sense the position of a person within a motor vehicle with reference to the amount of safety belt that is being withdrawn and may thus modify the operation of an air bag, if no safety belt is provided a different apparatus must be provided to sense the position of a person in a motor vehicle.

Figure 2 illustrates such a modified embodiment of the invention in which a motor vehicle 3 is provided with two seats 4, 5. An air bag to protect the person sitting in the seat 4 may be provided in a compartment 6 located in the dashboard 7 of the vehicle. In order to sense whether the person sitting in the seat is in a forward

position a transmitter 8 is provided mounted in the dashboard which transmits a signal laterally of the vehicle towards a reflector 9 mounted on the door 10 adjacent the seat 4. The reflected signal is transmitted to a detector 10 located adjacent the transmitter 8. The signal may be an optical signal or an audible signal. It will be appreciated that if a person sitting on the seat 4 is leaning forwardly the signal path will be blocked and will not be detected by the detector 10. As illustrated diagrammatically the detector 10 is connected to an alarm 11 which can operate in a manner similar to that of the alarm 3, thus modifying the operation of the air bag either by causing the air bag to be inflated utilising not all of the gas-generating ability or causing the air bag to be inflated with an exhaust port in an open condition.

Figure 3 illustrates a modified embodiment of the invention illustrated in Figure 2, but it is to be noted that in Figure 3 only a transmitter 8 is provided to transmit a single beam to a detector 12 which is mounted on the door 10 of the vehicle 3 adjacent the seat 4. The detector 12 is connected to an alarm 11.

As an alternative to utilising a transverse beam, as described with reference to Figures 2 and 3, the position of a person sitting in the seat 4 may be determined using a longitudinally extending beam, as illustrated in Figure 4. In this embodiment of the invention mounted on the dashboard 7 is a transmitter 13 which transmits the signal towards the seat 4. Mounted on the back of the seat 4 is a reflector 14 which can reflect the signal to a detector 15 located adjacent the transmitter 13. When a person is sitting on the seat 4 the time taken for the beam from the transmitter 13 to reach the front of the person and then to be reflected to the receiver 15 is indicative of the position of the

person in the seat. If the person leans forward, then the transmission time will reduce. The beam may comprise a beam of sound energy, such as ultra-sonic sound, with the arrangement working in a similar manner to that of a conventional echo-sounder. The beam may be an electro-magnetic beam with the device working in a manner of convention radar. The beam may even be an optical beam, but in any event the position of the person sitting on the seat 4 is determined, by the detector 15 and an appropriate signal is sent to the alarm 11 when circumstances so dictate. Instead of utilising the beam which is transmitted and reflected it is possible to use any arrangement which can sense the position of the person in the seat 4 relative to the dashboard 7. Such an arrangement may comprise an arrangement as used in an automatically focussing camera. Many different such arrangements exist but it will be appreciated that any convenient range-finder or distance-measurer may be utilised in embodiments of the invention.

Whilst the invention has been described with reference to an arrangement adapted to provide a degree of protection for a person in a passenger seat 4 of a motor vehicle it is to be appreciated that appropriately adapted arrangement may be provided to provide a degree of safety for a person sitting in the driver's seat 5 of the vehicle.

Many modifications will suggest themselves of those skilled in the art. For example, while reference has been made to utilising only part of the gas generating capacity available in order to inflate an air bag when a person is sensed to be in an improper position, instead the air bag utilised may comprise an inner air bag and an outer air bag, and when the person is in the improper position only the inner air bag would be inflated.

CLAIMS:

1. A safety arrangement for use in a motor vehicle, said arrangement comprising means to sense the position of a person in a motor vehicle relative to the seat and to generate a signal indicative of the fact that the person is not in the correct position on the seat and means to activate an alarm in response to said signals.  
5
2. A safety arrangement according to claim 1 wherein the alarm comprises a visible alarm.  
10
3. A safety arrangement according to claim 1 or 2, wherein the alarm comprises an audible alarm.
4. A safety arrangement according to any one of the preceding claims incorporating an air bag, wherein the alarm comprises means to modify the operation of the air bag.  
15
5. A safety arrangement according to any one of the preceding claims wherein the means to sense the position of a person in a motor vehicle comprise means adapted to determine when the length of the safety belt, which is to restrain the person, withdrawn from a retractor reel associated with the safety belt exceeds a predetermined limit.  
20  
25
6. A safety arrangement according to claim 5, wherein the alarm is only activated when the length of belt withdrawn from the reel has exceeded the predetermined limit for a predetermined period of time.  
30
7. A safety arrangement according to claim 5 or claim 6, wherein the means to activate the alarm are adapted to determine the length of belt withdrawn from a retractor reel to retain a person within a seat in a motor vehicle  
35

and to sense when a predetermined additional length of belt is withdrawn from the reel.

5 8. An arrangement according to any one of claims 5 to 7, wherein an optical sensor is provided to sense the withdrawal of belt from the reel.

10 9. A safety arrangement according to any one of claims 1 to 4, wherein said sensing means comprising means adapted to transmit a signal and to detect a signal, the nature of the detected signal being modified if the person is not in the correct position in the seat.

15 10. An arrangement according to claim 9, wherein the signal is transmitted laterally of the motor vehicle, and the signal path is blocked by a person when not in the correct position in the seat.

20 11. An arrangement according to claim 10, wherein the signal is an optical signal.

12. An arrangement according to claim 10, wherein the signal is an acoustic signal.

25 13. An arrangement according to any one of claims 10 to 12, wherein the signal is transmitted laterally of the motor vehicle and is reflected back to a detector adjacent the transmitter.

30 14. An arrangement according to any one of claims 10 to 12, wherein the signal is transmitted laterally to a motor vehicle from a transmitter to a detector.

35 15. An arrangement according to claim 9, wherein the signal is transmitted axially of the motor vehicle.

16. An arrangement according to claim 15, wherein the

5 signal is an acoustic signal and the time taken for the signal to be transmitted from a transmitter and to be reflected by the person sitting on the seat and to be detected at a detector is measured, in the manner of an echo sounder.

10 17. An arrangement according to claim 10, wherein the signal is an electromagnetic signal and the time taken for the signal to be transmitted, reflected by a person sitting in the seat and detected by a detector is measured, in the manner of a radar system.

15 18. An arrangement according to any one of claims 1 to 4, wherein the sensing means comprises an optical range-finding apparatus.

20 19. An arrangement according to any one of claims 9 to 18, wherein an air bag is provided, and wherein the alarm comprises means to modify the operation of the air bag.

25 20. An arrangement according to claim 4, or claim 19, wherein the operation of the air bag is modified in that not all of the gas generating capability of the air bag is utilised.

30 21. An arrangement according to claim 4 or 19 or 20, wherein the operation of the air bag is modified in that an exhaust port for the air bag is opened when the air bag is inflated.

35 22. An arrangement according to claim 4 or claim 19, wherein the operation of the air bag is modified in that the air bag consists of two concentric air bags, only the inner air bag being inflated when the alarm is activated.

23. A safety arrangement substantially as herein described with reference to and as shown in Figure 1 of

the accompanying drawings.

5 24. A safety arrangement substantially as herein described with reference to and as shown in Figure 2 of the accompanying drawings.

10 25. A safety arrangement substantially as herein described with reference to and as shown in Figure 3 of the accompanying drawings.

26. A safety arrangement substantially as herein described with reference to and as shown in Figure 4 of the accompanying drawings.

15 27. Any novel feature or combination of features disclosed herein.